

Basic Geodesy

Article 15

December 2008

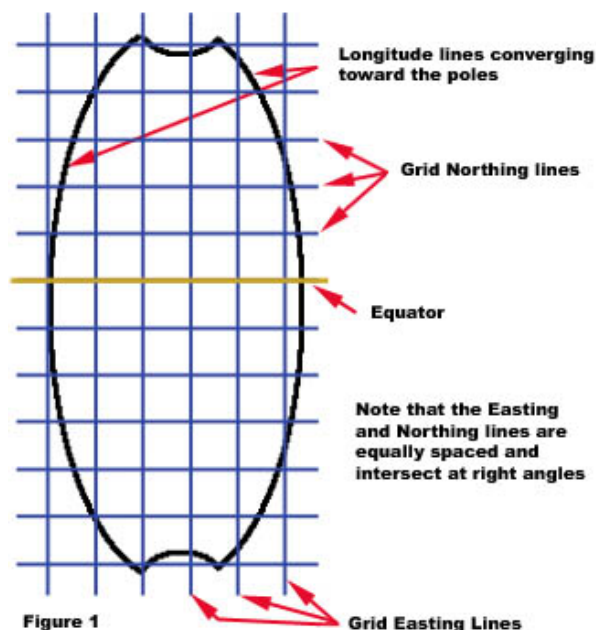
Why Do We Have Grids on Maps?

Roger Foster
Coordinate System Analysis Branch (CSAT)

Grids are needed because it is much more difficult to calculate distance (range) and direction (azimuth) from geographic coordinates than with rectangular X, Y grid coordinates. Furthermore, grids make land navigation and location referencing much easier for land-based operations. Latitude and longitude are appropriate for referencing a single location in relation to the rest of the earth, but for referencing numerous locations in relation to each other, within a relatively small area, latitude and longitude becomes very cumbersome.

Lines of latitudes are not equally spaced on most maps. This makes it very difficult to accurately identify a geographic location on the map. A map grid system is a series of parallel lines equally spaced that intersect at right angles. The lines running in a North-South map direction are referred to as Eastings, while the lines running in an East-West map direction are referred to as Northings. (Figure 1)

In the example shown on Page 2, Figure 2, we are assuming that a commanding officer is landing troops on the coast of a friendly country at the point marked by a red square. He intends to march them to the end of the runway marked by a red circle. He wants to know the distance (range) and direction (azimuth) between these two points. Using Pythagorean's theorem, the metric grid system on this "map", and trigonometry, we are able to determine these answers. It is important to note that, on a compass, Magnetic North is considered 0° and depending on the quadrant of your starting and ending points, you may need to add 90°, 180°, or 270° to the angle determined using trigonometry in order to determine the azimuth.



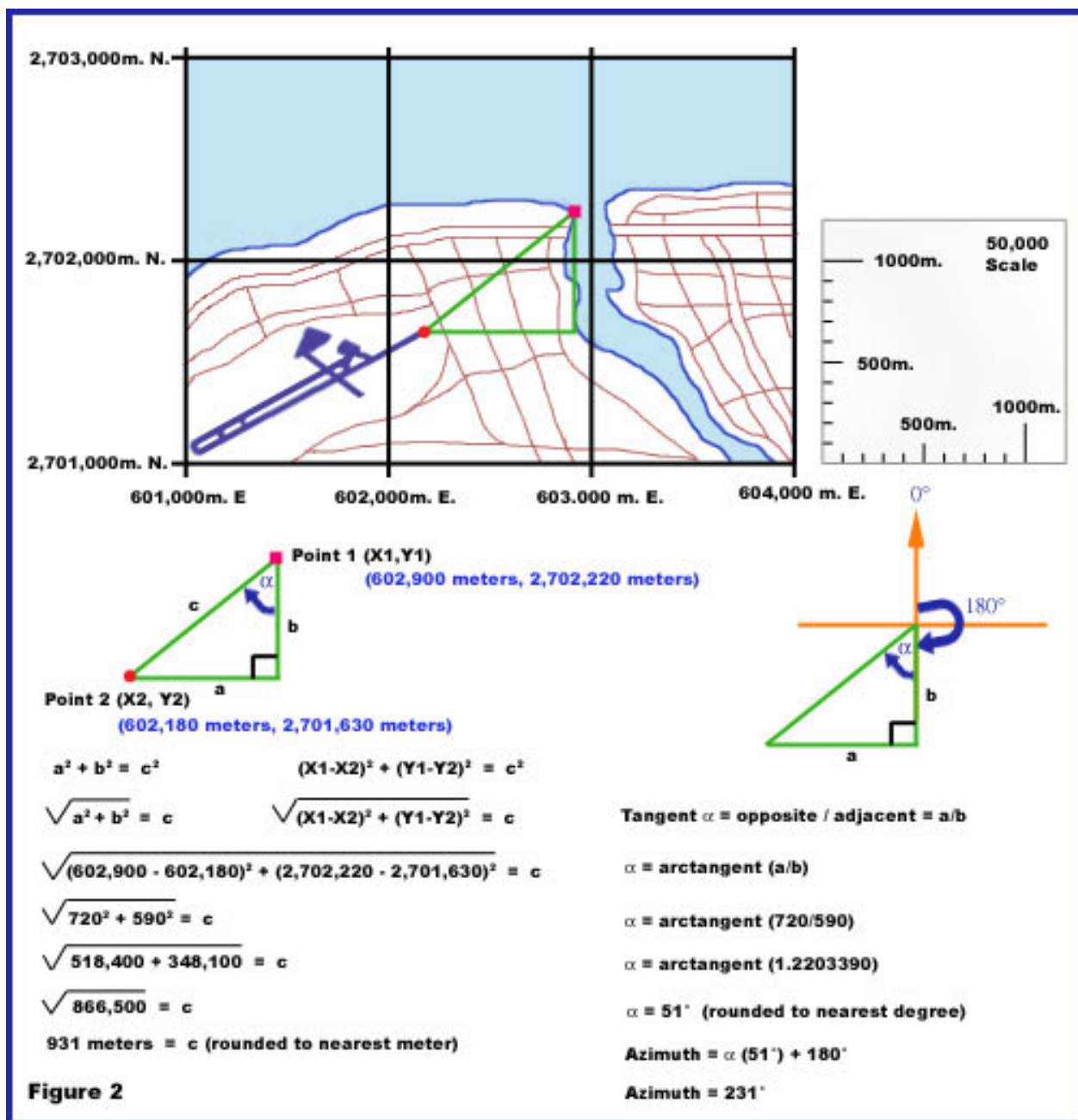
Grid Systems

There are many grid systems used in the world today. These include Lambert, Transverse Mercator (TM, also known as "Gauss-Kruger"), Universal Transverse Mercator (UTM), and Universal Polar Stereographic (UPS).

There are also various grid units of measurement including meters, yards, feet, and non-standard units. While NGA prefers to use UTM grids for mapping between 80° South and 84° North, and UPS for Polar mapping, many foreign maps and data use different grid systems. It is impossible to provide a conversion note between two grid systems on different projections and the maps may have secondary grid ticks to enable determination of grid values on both systems.

Next Article

The next article will concentrate on the grid system used on most NGA topographic products, the Universal Transverse Mercator grid.



NGANet Basic Geodesy Article Archive – <http://jws.stl.nga.ic.gov/products/gandg/coordsys/geoarticles/geoarticles.html>

Previous Articles:

Article 00 – Introduction

Article 01 – Shape of the Earth

Article 02 – Ellipsoids

Article 03 - Earth Centered Ellipsoids

Article 04 – Horizontal Datums

Article 05 – Geodetic Coordinates

Article 06 – Geoids and Vertical Datums

Article 07 - Gravity

Article 08 – Ideal Maps

Article 09 – Projection Surfaces

Article 10 – Mercator Projection

Article 11 – Polar Stereographic Projection

Article 12 – Lambert Conformal Conic Projection

Article 13 – Transverse Mercator Projection

Article 14 – Projections and NGA Products